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GROWTH AND YIELD RESPONSE OF COWPEA (*Vigna unguiculata L. Walp.)* AS AFFECTED BY PHOSPHORUS LEVELS AND BRADYRHIZOBIAL STRAINS IN KANO STATE, NIGERIA

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ABSTRACT
Field trials were conducted during the 2015 wet season at the Bayero University Kano Teaching and Research Farm and National Institute of Horticultural Research Technology (NIHORT), Bagauda. The study was conducted to determine the effect of phosphorus levels and Bradyrhizobial strains (USDA 3384 and 3451) on the growth and yield of cowpea varieties in the Sudan savanna zone of Nigeria. The treatments consisted of four (4) cowpea varieties (UAM-09-1051-1, IT99K-573-2-1, IT99K-573-1-1, and TVX 3236), two (2) levels of Bradyrhizobium (0, and 100 g/ha) and three (3) levels of phosphorus fertilizer (SSP) (0, 20, and 40 kg/ha) which were laid out in a Split Plot Design (SPD) and replicated three (3) times. Phosphorus levels and inoculation were allocated to the main plot while variety occupied the sub plot. The result revealed that application of 40 kg/ha P_2O_5 statistically recorded the highest grain yield ha^{-1} ()at BUK. No significant phosphorus effect was recorded on grain yield ha^{-1} at Bagauda. *Bradyrhizobium* Spp. Inoculation on cowpea had also maintained a consistent result across the two locations with the exception of emergence count which was found to be higher at Bagauda and BUK respectively. Significantly higher grain yield was observed from inoculated plants at BUK (1007.220 kg/ha) and Bagauda (719.91 kg/ha). The findings of the study also revealed that there was significant varietal effect on cowpea growth performance at both study locations. Higher grain yield was recorded from variety IT99k-573-2-1 (1193.400 kg/ha), followed by variety TVX 3236 (950.900 kg/ha) and IT99k-573-1-1 (776.500 kg/ha) at BUK while no significant effect of variety was recorded at Bagauda. Based on the result of the study, application of 40 kg/ha P_2O_5 can be recommended for better cowpea growth and yield at BUK. Similarly, variety IT99k-573-2-1 can be recommended to BUK location.

Keywords; USDA 3384 and 3451, Cowpea varieties, Phosphorus ad Sudan savannah

Introduction

Cowpea (*Vigna unguiculata* L. walp) is one of several species of the widely-cultivated genus *Vigna*. Four sub-species are recognized; of which three are cultivated (*V. textilis*, *V. pubescens*, and *V. sinensis*). Cowpea is one of the most important food legume crops in the semi-arid tropics covering Asia, Africa, southern Europe and Central and South America (Singh *et al.*, 2003). It also has the ability to fix atmospheric nitrogen through its root nodules, and grows well in poor soils with more than 85% sand and less than 0.2% organic matter with low levels of phosphorus (Singh *et al.*, 2003). Cowpea (*Vigna unguiculata* (L) Walp) is an important legume crop in Nigeria. It is the source of more than half of the plants protein of human diet in most African countries (Haruna and Aliyu, 2011). It can fix its own nitrogen thus improves soil fertility by leaving a fixed soil nitrogen deposit of up to 60 – 70 kg/ha for the succeeding crop. As important as the crop is, its production is still low due to insufficient information on existing and improved varieties, inadequate nutrition, climatic factors, and poor weed control management practices. Phosphorus is among the most needed elements for crop production in many tropical soils, it is critical to cowpea yield because it is reported to stimulate growth, initiate nodule formation and influence the efficiency of the rhizobium-legume symbiosis (Haruna and Aliyu, 2011). It is required in large quantities in young cells such as shoot and root tips where metabolism is high and cell division is rapid. It also aids in flower initiation, seed and fruit development (Ndakidemi and Dakora, 2007). However, many tropical soils are P-deficient (Osodeke, 2005). Biological nitrogen fixation from legumes offers more flexible soil and crop management than applied in organic nitrogen fertilizer because the pool of organic nitrogen becomes slowly available to non-legume species (Peoples, Herridge & Lahda, 1995). Soil microorganisms play a key role in soil P dynamics and subsequent availability of phosphate to plants (Richardson, 2001). Based on the foregoing and in order to enhance phosphorus availability for increasing cowpea production, inoculation of rhizobium can be considered as an option. Therefore, the main Objectives of this research are to evaluate the influence of phosphorus levels and Bradyrhizobium strains (USDA 3384 and 3451) on the growth and yield of some cowpea (*Vigna unguiculata* L. Walp) varieties in the sudan savanna zone of Nigeria.

Materials and Methods

Experimental Site

Field-trials were conducted during the 2015 wet season at Bayero University Kano Teaching and Research Farm (11^0 58'N, $8^0$25'E and 475 m above sea level) and National Institute of Horticultural Research Technology (NIHORT) Bagauda (lat. 12^0 08'N, long. 8^0 32'E, 500 m above sea level). Both sites are located in the Sudan savannah agro-ecological zone of Nigeria. The soil of the experimental site was sandy loam in texture and neutral in reaction with low organic carbon (<5 g/kg soil), total N (<1 g/kg soil) and available P (<10 mg/kg soil) according to FPDD (2002) soil fertility ratings. Also, the exchangeable basis Ca, Mg, Ka, and Na were moderate in the soil as well as the CEC.

Treatments and experimental Design

The experiment consisted of twenty-four (24) treatments, four cowpea varieties (UAM09-1051-1, IT99K-573-2-1, IT99K-573-1-1, and TVX 3236), *Bradyrhizobial* strains (3384 and 3451) at two levels (0, and 100 g/ha) and three levels of phosphorus fertilizer (SSP) (0, 20, and 40 kg P_2O_5 ha^{-1}) these were laid out in a Split Plot Design (SPD). Phosphorus levels and inoculation were allocated to the main plot while variety occupied the sub plots in three replications. The plot size was 13.5 m^2 (gross plot) and 3.375 m^2 (net plots). The land was harrowed, ploughed and ridged at 75cm apart using tractor after which the plots were demarcated at required plot size. A space of one meter between the plots and two meter between replicates was used as borders. Weeds were controlled by three hoes weeding at three, six, and twelve weeks interval after sowing (WAS). Insect pests were controlled by spraying Cypermethrin before and after flower formation to control cowpea thrips and karate 5EC was later sprayed for control of cowpea pod insects. The cowpea was harvested through handpicking as soon as many pods were matured and dried.

Seed inoculation

Seeds were inoculated with peat inoculants containing strain of *Bradyrhizobium* Sp. USDA 3384 and 3451 at the rate of 10g inoculants per one kg of cowpea. 100g of brown sugar was dissolved in 90 ml of warm water which was used as sticker to ensure adhesion of the inoculants. These were applied on each one kg of cowpea seed as recommended. The mixed seeds were allowed to air-dry for few minutes under shade before sowing.

Data Collection and Analysis

Three Plants were selected and tagged in the net plot for collection of data in both locations. The data collected were; emergence count, number of leaves per plant, number of branches per plant, crop growth rate was determined at 10 WAS using the formula (CGR=$\frac{W2-W1}{t_2-t_1}$g/wk) suggested by Watson (1958) and grain yield (kg ha^{-1}) was measured using a weighing scale. The data collected were subjected to Analysis of Variance (ANOVA) procedure for Split Plot Design (SPD). F-test was used to test for the level of significance using SAS software. (SAS Institute, 2014).. Significantly different means were separated using Duncan's Multiple Range Test (DMRT) at $P < 0.05$ (Duncan, 1959).

Results and Discussion

Emergence count

The effects of phosphorus, *Bradyrhizobial* strain and variety on emergence count of cowpea is presented in Table 1. There was no significant effect of phosphorus on the emergence count of cowpea at both locations. The effect of *Bradyrhizobial* strain on emergence count of cowpea was only significant at Bagauda where plants inoculated with 100 gha^{-1} rhizobium produced more stands at emergence than the control. There was no significant influence of variety on the emergence count of cowpea at both locations. Similarly, there was no significant interaction on emergence count of cowpea at both locations and sampling periods.

Number of Leaves per plant

The effect of phosphorus on number of leaves per plant of cowpea was only significant at 3 WAS in BUK (Table 2), where application of 20 kg P_20_5 ha^{-1} resulted in more number of leaves per plant while plants not treated with phosphorus recorded the least number of leaves per plant that were statistically with 40 kg P_20_5/ha. The effect of variety on number of leaves per plant was Significant at 3 and 6 WAS at BUK and at all sampling periods at Bagauda. At 3 WAS in BUK variety TVX 3236 significantly recorded more number of leaves per plant which was comparable to variety IT99K-573-1-1, the least number of leaves per plant was recorded by variety IT99K-573-2-1, also at 6 WAS variety TVX 3236 produced the highest number of leaves per plant which was statistically comparable to variety UAM09-1051-1. Varieties IT99K-573-1-1 and IT99K-573-2-1 produced the least number of leaves per plant. At 3 WAS in Bagauda, variety IT99K-573-2-1 recorded the highest number of leaves per plant which were statistically comparable to other varieties except variety UAM09-1051-1which produced the least number of leaves per plant. The least number of leaves per plant was recorded from variety IT99K-573-2-1 and was statistically similar to variety UAM09-1051-1. At 6 WAS variety TVX 3236 produced more number of leaves per plant than variety IT99K-573-2-1 but was statistically comparable to the other varieties. However, at 9 WAS in Bagauda, variety TVX 3236 produced more number of leaves per plant which were statistically at par with variety IT99K-573-2-1 while variety UAM09-1051-1 recorded least number of leaves per plant.

Number of Branches per plant

There was no significant difference on the effect of Phosphorus on number of branches per plant at both locations and sampling periods (Table 3). Similarly, there was no significant effect of *Bradyrhizobial* strain on number branches per plant at both locations and sampling periods. At 3 WAS in BUK variety TVX 3236 significantly recorded the highest number of branches per plant which were comparable to variety IT99K-573-1-1 and UAM09-1051-1, variety IT99K-573-2-1 recorded the lowest number of branches per plant. However, at 6 and 9 WAS variety TVX 3236 significantly recorded the highest number of branches per plant which were comparable to variety IT99K-573-2-1 and UAM09-1051-1. Variety IT99K-573-1-1 recorded the lowest number of branches per plant. Throughout the sampling period in Bagauda, the variety TVX 3236 consistently recorded the highest number of branches than the other varieties but was comparable to IT99K-573-2-1 at 3 WAS, and UAM09-1051-1 at 6 and 9 WAS.

Crop Growth Rate and Grain Yield kg ha^{-1}

There was no significant effect of phosphorus, *Bradyrhizobial* strain and variety on crop growth rate of cowpea at both locations and sampling periods (Table 4). Similarly, there were no significant interaction of phosphorus, *Bradyrhizobial* strain and variety on crop growth rate of cowpea at both locations and sampling periods. Effect of phosphorus on grain yield (kg ha^{-1}) of cowpea was only significant at BUK (Table 4) where the application of 40 kg $P_2O_5ha^{-1}$ resulted to higher yield (10) compared to control but was statistically comparable to plants that received 20 kg $P_2O_5ha^{-1}$. The effect of *Bradyrhizobial* strain on grain yield of cowpea was significant at both locations during the study period, where the application of 100g ha^{-1} of *Bradyrhizobial* strain resulted in significantly higher grain yield compared to control. The effect of variety on grain yield of cowpea was only significant at BUK where variety IT99K-573-2-1 gave the highest grain yield though at par with variety TVX 3236, variety IT99K-573-1-1 where as variety UAM09-1051-1 gave the lowest grain yield that was at par with variety TVX 3236. A significant interaction was observed between phosphorus and *Bradyrhizobial* strain in Bagauda (Table 5). Where the plant treated with 40kg P_2O_5 ha^{-1} and 100g ha^{-1} *Bradyrhizobial* strain produced the highest grain yield and the plant treated with only 40 kg ha^{-1} phosphorus gave lower yield.

Effect of Phosphorus on the Growth and Yield of Cowpea

Phosphorus is an essential nutrient serving both as a key to plant structure and as a catalyst in the conversion of numerous biochemical reactions in plant. Application of 40 kg $P_2O_5.ha^{-1}$ to cowpea gave a significant increase in plant height, number of leaves per plant, and leaf area index. This could be attributed to the positive response of cowpea to phosphorus as a vital compound of DNA. Increase in plant height leads to proportionate increase in number of leaves per plant and branches per plant with more chlorophyll content embedded which is critical in photosynthesis, dry matter accumulation and assimilates translocation from the source to the sink. This result agrees with the findings of Nkaa *et al.* (2014) who reported that Phosphorus fertilizer significantly enhanced growth and yield characters of the cowpea varieties used in his experiment; plant height, leaf area, number of leaves per plant and number of branches per plant in all the weeks of measurement were significantly improved. This result supported the observation reported by Nyoki *et al*. (2013) who stated that phosphorus supplementation significantly increased the number of branches per plant, and number of nodules per plant in both the screen house and field experiment relative to control, and for every parameter measured, supplementation of phosphorus at 40 and 80 kg $P_2O_5.ha^{-1}$ produced greater values of the above mentioned yield components over other treatments but numerically 80 kg $P_2O_5.ha^{-1}$ produced greater values of all parameters measured relative to other treatments. The non-significant response of some of the growth parameters recorded could be due to the lower soil pH which could have affected the supplied P and resulted to slow release. Jodie and Peter (2000) reported that phosphorus in soil is generally abundant, but at pH < 5.5 it reacts readily with Aluminum and calcium to form insoluble compounds in which the reaction results in very low phosphorus availability and efficiency of phosphorus fertilizer use by plant. The significant effect of phosphorus on grain yield in this study indicated that 40 kg $P_2O_5.ha^{-1}$ gave better result. This result is in conformity with the findings of Aliyu *et al.* (2013) who reported that grain yield significantly increases with increased levels of phosphorus. Similarly, this is also in conformity with the findings of other researchers; (Okeleye and Okelana, 2000; Haruna and Usman, 2013; Ntare and Bationo, 2002; Nyoki *et al*., 2013; Singh *et al*., 2011 and Ndor *et al*., 2012) who reported significant increase in yield of cowpea in response to phosphorus application. Various studies by (Cassman *et al*., 1981; Giller *et al*., 1998; Israel, 1993; Pereira and Bliss, 1987; Ssali and Keya, 1986), have found that with adequate P supply, symbiotic performance can be increased, leading to greater grain yield. However, studies by (Da Silva *et al*., 2012; Ndakidemi *et al*., 2006) found that, for farmers who can afford P fertilizers their combined use with rhizobial inoculants can farther increase grain yield, enhances symbiotic establishment for increased N_2 fixation, and reduce the declining state of soil fertility in Africa. However, Agboola and Obigbesan (2001) reported that phosphorus application did not significantly increase cowpea yield but rather enhanced nodulation and phosphorus content of leaf and stem.

Effect of *Bradyrhizobial* Strain on Growth and Yield of Cowpea

Rhizobium inoculation is a significant technology for the manipulation of rhizobia for improving crop productivity and soil fertility. In this study no significant effect of rhizobia was found on the growth parameters throughout the periods of evaluation. In view of this, Giller (2008) reported that legumes form nodules with a wide range of rhizobia that are present in most soils, termed “promiscuous” or “naturally-nodulating” grain legumes, and make effective use of the inherent soil biodiversity of rhizobia. This result goes contrary to the findings of Nyoki and Ndakidemi (2014a), whom found out that rhizobia inoculation in cowpea significantly improved the performance cowpea on some parameters measured at 4, 6 and 8 WAS in both screen house and field experiments relative to the control treatment. Grain yield were significantly influenced by *Bradyrhizobial* strain inoculation. However these responses have indirect bearing to the lack of significance response of rhizobium on the growth and some yield components.

Significant response of yield to inoculation with *Bradyrhizobial* strain was documented by several authors. Bhuiyan *et al*. (2009) reported that *Rhizobium* inoculated plants gave significantly higher grain yield compared with un-inoculated (control). Bambara and Ndakidemi (2010) also reported that *Rhizobium* inoculation significantly improved the yield and all other yield components such as number of pods.plant^{-1}, number of seeds.Plant^{-1}, 100-seed weight, and seed yield compared with control. Dravid (1991) also supported that rhizobium significantly improves crop yield in many legumes. Raj and Patel (1991) reported that rhizobium inoculation increases seed yield by 0.15 t ha^{-1}.

Effect of Variety on Yield and Growth of Cowpea

Variety IT99K-573-2-1 produced taller plants compared to other varieties used in both locations. While throughout the sampling periods at Bagauda, variety IT99K-573-1-1 produced taller plants. This can be attributed to response of photosynthetic apparatus to increased demand for assimilates due to rapid seed growth and development. Higher seed yield ha^{-1} was obtained from variety IT99K-573-2-1 followed by variety IT99K-573-1-1. This result is in line with the findings of Nkaa *et al.* (2014) who reported that High yield values were observed in variety IT99K-573-2-1, followed by IT99K-573-1-1 and IT97K-499-35. This is because highest value in most of the yield characters measured was observed in variety IT99K-573-2-1 at phosphorus fertilizer rate of 40kg P_2O_5.ha^{-1}, this contradicts the findings of Haruna and Usman (2013) who recorded highest yield at 30kg P_2O_5.ha^{-1} in their experiment and Singh *et al*., (2011) who reported highest yield at 60kg P_2O_5.ha^{-1} , and suggested that this may be the optimum, as further application of phosphorus could result to increase or decrease in yield of cowpea. The significant response of the measured yield characters of cowpea to phosphorus application could be attributed to the role of phosphorus in seed formation and grain filling (Haruna, 2011). The lack of significance on the grain yieldha^{-1} of some varieties at Bagauda could be attributed to high rainfall pattern (505.7 ml) of the location at a particular point in time as the crop does not perform well in an environment with erratic rainfall or waterlogging. The observed variations in the performance of the cowpea varieties used could due to the fact that some of the genotypes used responds well to *Rhizobium* inoculation, and has efficiency to perpetuate in phosphorus deficient soils to reduce fertilizer cost.

Conclusion

Amongst the improved varieties used for this research, variety IT99k-573-2-1 gave significantly higher yield. The application of 40 kg/ha phosphorus fertilizer produced significantly higher yield. However, cowpea inoculation with *Bradyrhizobial* strain produced higher yield at one of the locations selected for this trial (Bagauda). Thus, *Bradyrhizobial* strain inoculation, supplementation with phosphorus and improved variety can bring about a constructive effect in improving photosynthesis, nutrient uptake, nodulation, growth, yield and economic benefits in legumes. Based on the current study, application of 40 kg/ha P_2O_5 can be recommended for better cowpea growth and yield at BUK. Similarly, variety IT99k-573-2-1 can be recommended at BUK only.

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Table 1: Emergence Count of cowpea as Affected by *Bradyrhizobial* strain, Phosphorus and Variety during the 2015 wet season

Treatments	**BUK Emergence count**	**BAGAUDA Emergence count**
Phosphorus (kg/ha)		
0	58.63	59.08
20	53.87	57.21
40	47.79	57.38
SE±	4.53	1.53
***Bradyrhizobial* Strain(g/ha)**		
0	52.37	55.94b
100	56.21	59.83a
SE±	3.69	1.25
Variety		
IT99K-573-1-1	43.67	58.33
IT99K-573-2-1	52.88	58.78
UAM-09-1051-1	60.52	55.97
TVX 3236	60.14	58.65
SE±	5.25	1.78
Interaction		
P*R	NS	NS
P*V	NS	NS
R*V	NS	NS
P*R*V	NS	NS

Means followed by the same letter in a column are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT). NS: Not significant P: Phosphorus, V: variety, R: *Bradyrhizobial* strain.

Table 2: Cowpea number of leaves as affected by *Bradyrhizobial* Strain, Phosphorus and variety during the 2015 wet season

Treatments	BUK			BAGAUDA		
	3 WAS	6 WAS	9 WAS	3 WAS	6 WAS	9 WAS
Phosphorus (kg/ha)						
0	18.14b	121.43	130.25	16.27	98.53	95.33
20	20.77a	118.99	121.04	18.60	96.72	101.58
40	19.33ab	117.90	126.40	17.03	98.53	108.63
SE±	0.714	5.102	8.07	0.80	6.91	7.16
***Bradyrhizobial* Strain (g/ha)**						
0	18.811	120.468	132.686	17.257	95.977	100.06
100	19.961	118.458	119.435	17.339	96.140	103.64
SE±	0.58	4.17	6.60	0.66	5.65	5.84
Variety						
IT99K-573-1-1	20.48ab	112.34b	114.39	16.67ab	95.20ab	100.00bc
IT99K-573-2-1	16.62c	110.62b	122.24	8.78a	80.29b	104.33ab
UAM-09-1051-1	18.29bc	121.06ab	136.47	15.77b	95.39ab	79.16c
TVX 3236	22.25a	134.01a	130.21	18.11ab	114.40a	126.53a
SE±	0.83	5.91	9.35	0.93	8.00	8.29
Interaction						
P*R	NS	NS	NS	NS	NS	NS
P*V	NS	NS	NS	NS	NS	NS
R*V	NS	NS	NS	NS	NS	NS
P*R*V	NS	NS	NS	NS	NS	NS

Means followed by the same letter (s) in a column are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT). NS: Not significant P: Phosphorus, V: variety, R: *Bradyrhizobial* strain

Table 3: Number of branches per plant of cowpea as affected by *Bradyrhizobial* strain, Phosphorus and Variety during the 2015 wet season

Treatments	BUK			BAGAUDA		
	3 WAS	6 WAS	9 WAS	3 WAS	6 WAS	9 WAS
Phosphorus (kg/ha)						
0	5.99	14.29	14.68	5.28	10.92	14.65
20	6.66	14.49	14.02	5.10	11.67	14.86
40	6.03	14.33	17.48	5.28	11.83	14.47
SE±	0.29	0.62	0.47	0..14	0.39	0.44
***Bradyrhizobial* Strain (g/ha)**						
0	6.32	14.39	15.000	5.20	11.60	14.81
100	6.11	14.34	15.810	5.03	11.34	14.52
SE±	0.23	0.50	0.39	0.11	0.316	0.36
Variety						
IT99K-573-1-1	6.050ab	12.40b	13.28b	5.03bc	10.65b	14.17ab
IT99K-573-2-1	5.52b	13.55ab	14.98ab	5.19ab	11.19b	13.94b
UAM-09-1051-1	6.52ab	15.12ab	15.12ab	4.72c	11.49ab	14.96ab
TVX 3236	6.77a	16.43a	18.46a	5.57a	12.62a	15.64a
SE±	0.33	0.71	0.55	0.16	0.45	0.50
Interaction						
P*R	NS	NS	NS	NS	NS	NS
P*V	NS	NS	NS	NS	NS	NS
R*V	NS	NS	NS	NS	NS	NS
P*R*V	NS	NS	NS	NS	NS	NS

Means followed by the same letter (s) in a column are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT). NS: Not significant P: Phosphorus, V: variety, R: *Bradyrhizobial* strain

Table 4: Crop growth rate and Grain yield (kg ha^{-1}) of cowpea as affected by *Bradyrhizobial* strain, Phosphorus and Variety during the 2015 wet season

Treatments	BUK		BAGAUDA	
	CGR (10 WAS)	Yield kg ha^{-1}	CGR (10 WAS)	Yield kg ha^{-1}
Phosphorus (kg/ha)				
0	145.31	735.500b	141.50	635.63
20	146.56	875.900ab	142.50	654.69
40	203.34	1110.100a	156.17	644.81
SE±	8.73	84.66	9.39	65.02
***Bradyrhizobial Strain* (g/ha)**				
0	150.12	802.24b	149.54	570.18b
100	180.13	1007.22a	144.02	719.91a
SE±	7.13	69.54	7.67	52.78
Variety				
IT99K-573-1-1	149.37	776.50b	152.77	607.50
IT99K-573-2-1	155.49	1193.40a	136.44	637.30
UAM-09-1051-1	150.71	729.00b	143.72	772.40
TVX 3236	208.43	950.90ab	136.44	550.60
SE±	9.91	98.59	10.877	74.64
Interaction				
P*R	NS	NS	NS	*
P*V	NS	NS	NS	NS
R*V	NS	NS	NS	NS
P*R*V	NS	NS	NS	NS

Means followed by the same letter (s) in a column are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT). NS: Not significant P: Phosphorus, V: variety, R: *Bradyrhizobial* strain

Table 5: Interaction between Phosphorus and *Bradyrhizobial* strain on grain yield (kg/ha) of Cowpea in Bagauda

	Phosphorus (kg/ha)		
Treatments	0	20	40
***Bradyrhizobial* Strain (g/ha)**			
0	694.60ab	555.40ab	460.60b
100	576.70ab	754.00ab	829.10a
SE ±		134.830	

Means followed by the same letter (s) in a column are not significantly different at 5% level of probability using Duncan Multiple Range Test (DMRT). NS: Not significant